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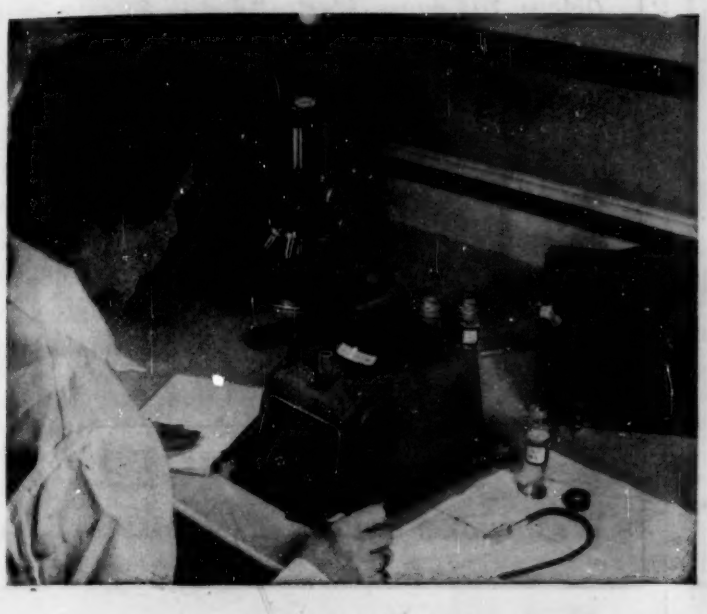

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THE WILDLIFE SOCIETY

By Dr. WALTER P. TAYLOR

PRESIDENT OF THE WILDLIFE SOCIETY

WHILE a strong federation of biologists, as suggested by Griggs,[1] is highly desirable, it may be a long time coming. In the meantime, biologists generally might well support with ever-increased vigor such unifying enterprises as the Division of Biology and Agriculture of the National Research Council, the Roster of Scientific and Specialized Personnel and the Union of American Biological Societies (and through it, *Biological Abstracts*). Then, too, the various special organizations should cooperate to the fullest extent with each other and the scientific public so that the science as a whole may be steadily advanced.

In this connection the work of some of these societies is none too well known to the scientific public, this being particularly true of those most recently organized. Perhaps it will help if the various groups know each other better.

[1] SCIENCE, 96: 2503, 546–551, December 18, 1942.

One of the active societies set up within the last few years is the Wildlife Society, organized in Washington, D. C., in February, 1936, to foster specifically the interests of wildlife specialists. Since that date the organization has steadily expanded until in 1942 there were two honorary, 309 active and 454 associate members.

As stated in its constitution, the principal objectives of the society are (1) establishment of professional solidarity and the maintenance of the highest possible professional standards; (2) development of all types of wildlife management along sound biological lines; (3) publications to effect these ends, and (4) protection of the interests of its members.

In pursuance of the first and fourth objectives the society has maintained a Committee on Professional Standards which has worked on such problems as proper qualifications for active membership, wildlife

curricula in the schools and civil service status of wildlife workers. No move has been made as yet to appraise and approve the schools which give wildlife training. In relation to the second objective, through vigorous efforts in research, restoration and administration, attempts have been made to advance the adequacy of wildlife services to the states and the nation as a whole.

The *Journal of Wildlife Management*, for six years under the editorship of W. L. McAtee, now under Dr. Tracy I. Storer, has already made a secure place for itself by the high standard of its contents, being, in part, a discharge of the society's responsibility for published results.

In view of the relative novelty of the term "wildlife" (formerly written as two words, now as one), the exact scope of the society's work at times has not been any too clear.

Redington and Higgins point out[2] that in its broadest sense wildlife would include every living organism in a state of nature. As covered by them, however, wildlife conservation embraced largely the vertebrate wild animals, chiefly the fishes, birds and mammals, with incidental mention of the amphibians, reptiles and shellfish. These authors further point out that when the lower forms, including fishes, are not specifically named, wildlife is considered to comprise chiefly birds (game, non-game and insectivorous) and mammals (game, fur-bearing and others) measures for the conservation of which are state-wide, national and international. Shelford's definition[3] regards wildlife as including ". . . all uncultivated plants and undomesticated animals native to our continent. . . ."

While a principal emphasis of the society is quite properly on game and game fish, its interests are by no means exclusive—indeed, if the wildlife specialist is to take proper care of fish and game interests he must, of course, be ecologically minded and must give some attention to all factors of environment which affect these things. Seemingly the founders had this in mind; at least they did not restrict the work of the society to game, apparently thinking of wildlife in a broad sense.

It may be helpful to explore briefly some of the possibly important cooperative relationships (in addition to fish and game conservation work) through which the work of the wildlife specialists impinges upon or is related to the activities of their biological colleagues.

EDUCATION

Emphasis upon more thoroughgoing and adequate *conservation education* looking toward the perpetuation of our basic natural resources (including soils, waters, range forage, forests, fisheries, wildlife and human life) has been marked at recent conventions of the Wildlife Society. Already teachers in the fields of natural history and wildlife management make up a prominent section of the membership. These members are working hard on a more effective public education in reference to the maintenance of those material elements which are so necessary in prosecuting a successful war or in a rehabilitation program following its conclusion.

PUBLIC HEALTH AND SANITATION

A threatening phase of the *public health* situation at the present time is that of bubonic (or pneumonic) plague on the Pacific Coast and in some of the other western states. Typhus fever in the South is also important. These are intimately associated with problems of wild animal life, particularly the brown rat, secondarily, in certain instances, with native rodent populations. The diseases transmissible from wild animals to man are many and numerous, some of them serious. The technical men of the Wildlife Society through cooperation with the medical sciences and public health groups can make a distinct contribution. Nor should malaria be overlooked. The proposed treatments for mosquito control by those with an engineering type of mind affect to such an extent the wildlife resources (including not only fishes and aquatic organisms of many sorts, and ducks and waterfowl, but human welfare as well) that this phase of the public health and sanitation program should not be neglected.

LAND USE AND LAND HEALTH

In many states, from the beginning of the recent "land use planning" movement, members of the Wildlife Society, in cooperation with extension services, the Bureau of Agricultural Economics and other public and private groups and individuals, have participated actively in assisting to work out improved plans for *land management*. This is as it should be. Land use and land health are so intimately related to undomesticated plants and animals, including the protozoa, bacteria, burrowing worms, insects, rodents and the other forms of life, animal and vegetable, within and above the surface of the soil that there is no possibility or desirability of disentanglement. The wildlife specialists have a large and important contribution to make, all in their proper sphere, to the cause of land use and land health.

BIOLOGICAL INTERRELATIONSHIPS

There is often too much of a tendency to specialize or compartmentalize. In reality there are no hard-

[2] In Van Hise and Havemeyer's "Conservation of Our Natural Resources" (Macmillan, 1931, p. 393).

[3] In Parkins and Whitaker's "Our Natural Resources and Their Conservation" (Wiley, 1936, p. 486).

and-fast boundary lines in nature, which is, after all, a single vast system of material and energy. A part of the universal energy circulates at any given moment through our domesticated species of birds, animals and plants, including ourselves. At the same time another part of it pulses through the natural undomesticated species, including all the groups of wild organisms (both plants and animals) which inhabit the earth. The wildlife specialist, who is at heart an ecologist, has some responsibility to assist in the interpretation and application of these principles, which have to do with so many phases of life and living and the basic materials which make existence possible.

CAMOUFLAGE

Military requirements have emphasized the need for effective camouflage. While it is true that representatives of architects, engineers or landscape artists have to a large extent monopolized this field, nevertheless the basic information comes from nature's own devices to conceal activities and operations of animals from their enemies or their prey. Wildlife specialists should be of increasing service to the armed forces and to educational institutions by cooperating aggressively with those who are working out problems in this field.

CONTROL—NATURAL, APPLIED AND CLIMATIC

As one of the most practical of all applications of biological theory, much of the *control* of *organisms* (especially of vertebrates) comes under the ken, interest and work of members of the Wildlife Society. The need is plainly apparent for improved discrimination in planning for control measures and for less wasteful application. While biological control has been utilized in an important way in economic entomology, its possibilities in other fields are only just now being given attention. The rapid and efficient transportation of men and materials over great distances threatens a spread of malaria, yellow fever and some of the other ailments from which, up to the present, remoteness has afforded protection. Already more than 50 biologists have been assigned to the Sanitary Corps of the United States Army.

CONSERVATION

As pointed out by many leading members of this society, the "conservation" in which its members are interested is not alone the protection of some particular game or fish species but proper care for all nature. The interests of man can not be served effectively unless the conservation enterprise addresses itself to all the basic production resources (including minerals, soils, waters, forage on the grazing range, forests, fisheries, wildlife, human life), indeed all those things that go to make up the resources for food, shelter, recreation and human vitality, which are essential for the survival of mankind.

RECREATION

England early found that her workers could not produce at the highest rate if they became over-tired. Needed is maximum production of all sorts of war materials (including food), not maximum exhaustion of all the workers. Emphasis upon outdoors living, camping, photographing, hiking, hunting and fishing in the intervals between work is important in wartime as well as in time of peace, for relaxation, rehabilitation and the building of morale.

COURSES ON OUTDOOR LIVING

Millions of American boys are now going to the ends of the earth, and many will be more or less dependent on living on the land. The success of camp life depends to a great degree on the extent to which individuals and groups can cooperate with nature, adapt themselves to unfamiliar environments, and win through to security. Fortunately courses in outdoor living are growing in number. The University of Michigan, Cornell University, Syracuse University, Iowa State College, the University of Missouri and several others are already giving these courses, which help to answer such questions as: How proceed when lost in an unfamiliar country? What is available for food? How about poisonous vegetation and animal life? How assure the maximum comfort and efficiency in living under unfamiliar conditions? How protect oneself against pests and diseases?

PRODUCTION OF FOOD AND SHELTER

The problems of food, clothing and shelter have recently received an increasing amount of attention. A new importance is attached to the hides of fur animals, the down from certain waterfowl, the skins of deer, elk and many other wild animals. Many of the materials derivable from the wild natural animal and plant kingdom are well known to the wildlife specialist, who is sometimes in a favorable position to be helpful to civilian and military establishments.

It has been emphasized that as sources of protein requirements of our people, the fishes of the sea are exceeded in value and importance only by pork and beef. Perhaps shark livers as sources of vitamins have received undue attention, but the millions of pounds of marine resources which may now be developed if the pinch becomes severe enough and if a program can be properly balanced have been little attended to or appreciated.

An immense amount of research and other work needs to be done in discovering, developing and using the expanding resources from "ocean pastures."

"Wildlife" should certainly be thought of as including marine and fresh-water fisheries as well as the terrestrial vertebrates; but some do not so understand it. In any case, the leadership of the brilliant group of technical and administrative men who have accomplished so much in the field of the commercial fisheries is appreciated. They deserve much credit from the public. The Fisheries Coordination Office, in placing a large number of trained men in the field and in Washington, dealing directly with the commercial production of fish and fish products, is entitled to the utmost support and cooperation.

Even the fresh-water ponds which are so conspicuous a feature of the work of some of the state conservation departments, extension services, the Soil Conservation Service and Agricultural Adjustment Agency activities in many parts of the United States are not to be depreciated. The figures are large as to potential production of a supplemental food supply from these farm ponds. Whether or not actual advance is made along these lines depends to a considerable extent upon the activities and leadership of technical men who are interested in inland fisheries and upon the provision of funds with which they can work. Their success in this field, supported by an intelligent government and an enlightened public opinion, may mean an appreciable contribution to the nation's food.

MILITARY NATURAL HISTORY

E. L. Palmer and others have emphasized the place of the military naturalist at this particular period—the man who knows something about the birds, mammals, reptiles, amphibians, fishes, worms and insects, as well as the plants of the numerous war fronts on which United Nations' soldiers are fighting. Some of the wildlife specialists are unusually well qualified to assist the Army, Navy and other branches in the preparation of manuals, instructions and directions for protection from inimical plants and animals and utilization of those which can be put to use.

In this connection it is of interest that nature is not unfriendly to those who know something about her. Even the arctic environment was pleasurable and livable to Stefansson. The terrible winter climate of continental Europe was friendly to the Russians, who understood it and used it, but inimical to the Germans, who did not understand it so well. The Japanese, by adapting themselves to their environment, were able to survive and conquer in the Malayan Peninsula. The war work of biologists is already extensive. The Special Services Branches of Army and Navy, the Desert, Arctic and Tropical Services of the Army Air Corps, the Sanitary Corps of the Army, the Quartermaster Corps, the Signal Corps, the Naval Research Laboratories and many others are using biologically trained men. But the work done and human resources in use are only a beginning.

POST-WAR ADJUSTMENTS

Truly, among the wildlife and conservation problems which will arise after the war will be many dealing with fish and game, but others also will require attention and specialized information. Wildlife specialists should cooperate in the outlining of post-war plans. Among these are included collaboration, through appropriate governmental departments and otherwise, in the authorship and administration of treaties for the protection and proper management of international wildlife and fisheries resources, including the products of the sea (whales, marine fishes, fur seals, etc.), wild birds and mammals.

In these considerations there is no thought of encroachment by this society on the work of others but rather the need for expansion of our understanding of what is meant by conservation, and for more thoroughgoing cooperation between biologists.

Paraphrasing, in general conservation terms, a recent statement by Shirley,[4] it may be confidently asserted that the basic production resources, including minerals, soils, waters, range forage, forests, fisheries, wildlife and human life, are indispensable, whether in peace or war. Sustained yield management of all the renewable natural resources to meet not only our own needs but those of other countries is one of the essentials for the establishment of an enduring people's peace. This will require some measure of public control (in which local communities as well as higher levels of government should participate), technical skill and recognition of the economic and ecological interdependence of the nations of the world. An immense field of service lies before conservation specialists, including wildlife workers and many others, who will be available and trained for leadership in organizing and manning the division of natural resources of a great world economic federation.

VITAMINS IN EDIBLE SOYBEANS

By Dr. PAUL R. BURKHOLDER

YALE UNIVERSITY

PRESENT world events forebode a general scarcity sooner or later of foods of animal origin, such as milk, cheese, eggs and meat, which are important in our diet because of their proteins and vitamins. In the future it may become necessary for us to rely

[4] *Journal of Forestry*, 41: 83, February, 1943.

more and more upon plant foods as substitutes for animal proteins. The cereals and legumes lend themselves in this role because they possess a high protein content and can be made to yield large crops within a single year.

Cereals, such as wheat, are already supplying a significant amount of protein in our diet. Among the legumes, soybeans constitute a rich source of proteins which by chemical analysis have been shown to contain in near optimum proportions the amino acids essential for the nutrition of animals and man. The excellence of soybean flour has been demonstrated recently in extensive feeding experiments with animals.[1] It has been known for a long time that cooking greatly improves the nutritional value of leguminous protein, and recent researches on soybeans amply confirm this fact.[2] Although soybeans and the numerous food products which can be made from them are eminently desirable from the nutritional view-point, their use as food thus far in America and Europe has been limited almost entirely to specialty items. That millions of Chinese have lived on a diet of rice and soybeans for thousands of years constitutes a great natural experiment from which much can be learned. In the future when large quantities of edible soybeans become available, and when food producers and the general public are educated to appreciate the qualities of desirable kinds of *Soja*, the various products made from them may play a more prominent role in the food supplies of Occidental peoples as they have for centuries past in the diets of Orientals.

It is now recognized that soybeans possess desirable qualities not alone by their contribution of amino acids for nourishing the body, but also through their stores of fatty materials and accessory growth factors —the vitamins. In studies on the choline content of many kinds of animal and plant products, Engel[3] found that soybeans rank higher than leafy vegetables, root crops or cereal grains in this important methyl compound. Hafner[4] has recently reported favorably upon the vitamin B complex and protein in soybean flour. Although several studies[5, 6, 7] have provided isolated bits of information about the vitamin content of soybeans, the subject has received less attention than it deserves.

The present paper constitutes a brief report on the analyses obtained for seven vitamins in six varieties of edible soybeans harvested as fresh green beans and also as dry mature beans. The soybeans supplied through the kindness of the grower, Everett Clark, of the Associated Seed Growers, Milford, Conn., were harvested in the autumn of 1942. Tests for ascorbic acid were made promptly on materials ground in metaphosphoric acid. Samples of the green beans were dried rapidly at 70° C. The dehydrated fresh material and mature seeds were stored in the laboratory until assays for the B vitamins were performed in April, 1943.

Both the green and the mature beans were ground in a small Wiley mill to facilitate extraction of the water-soluble vitamins. For the purpose of obtaining extracts, 0.5 gm of the ground material was placed in 30 ml of buffer solution at pH 4.5. The buffer solution contained 3.75 gm glacial acetic acid and 5.0 gm anhydrous sodium acetate per liter. Twenty milligrams of papain and 20 mg of Taka-diastase were added to each half gram sample, and the mixture was incubated at 37° C. for 24 hours. A few drops of benzene were used to inhibit growth of microorganisms. The digested material was heated in steam at 100° C. for 30 minutes, made up to a volume of 50 ml, filtered with supercel in a Büchner funnel and subsequently extracted with ether to re-

TABLE 1

VITAMINS IN EDIBLE VARIETIES OF SOYBEANS. DATA FOR B VITAMINS ARE GIVEN AS MICROGRAMS PER GRAM OF DRY MATTER. ASCORBIC ACID IS EXPRESSED AS MILLIGRAMS PER GRAM OF GREEN RAW BEANS

Variety	Thiamine		Riboflavin		Pyridoxine		Biotin		Niacin		Pantothen		Ascorbic acid
	G*	M†	G	M	G	M	G	M	G	M	G	M	G
Aoda	5.6	9.6	4.1	2.3	2.9	6.3	0.66	0.63	46	20	11	11	0.24
Bansei	6.6	8.4	3.5	2.4	3.3	6.2	0.42	0.62	44	23	12	12	0.21
Giant Green	7.6	8.5	3.6	2.1	4.2	7.4	0.52	0.69	26	19	11	14	...
Hokkaido	6.6	9.5	3.0	2.3	3.2	6.6	0.54	0.51	37	20	12	11	0.18
Toku	5.6	9.0	3.1	2.1	3.5	5.4	0.66	0.72	40	19	12	12	0.19
Willomi	6.2	9.2	4.5	2.4	3.9	6.3	0.43	0.49	48	20	13	12	0.23
Means for six varieties	6.4	9.0	3.5	2.3	3.5	6.4	0.54	0.61	40	20	12	12	0.21

* G = Green or immature.
† M = Mature.

[1] D. Breese Jones and J. P. Divine, *Soybean Digest*, September, 1942.
[2] J. W. Hayward and F. H. Hafner, *Poultry Sci.*, 20: 139, 1941.
[3] R. W. Engel, *Jour. Nutr.*, 25: 441, 1943.
[4] F. Hafner, *Bakers Digest*, 16: 247, 1942.
[5] Lela E. Booher *et al.*, U.S.D.A. Circular No. 638, 1942.
[6] J. O. Lampen *et al.*, *Jour. Nutr.*, 23: 11, 1942.
[7] R. W. McVicar and G. H. Berryman, *Jour. Nutr.*, 24: 235, 1942.

move fatty substances which might have interfered with the microbiological assays. A separate series of analyses, in which the ether extraction was omitted, yielded a similar set of results. Pyridoxine was assayed with a yeast growth method.[8] Riboflavin, biotin, niacin and pantothenic acid were tested in accordance with methods published by R. J. Williams *et al.*[9] Thiamine was determined by the yeast fermentation method.[10] Ascorbic acid was measured by the technique of Evelyn *et al.*[11]

TABLE 2

COMPARISON OF VITAMINS IN MEAT,[12] WHEAT AND MATURE SOYBEANS. DATA ARE EXPRESSED AS μGM PER GRAM OF DRY MATTER

Food	Thiamine	Riboflavin	Pyridoxine	Biotin	Niacin	Pantothen
Beef round	2.1	7.5	2.6	.08	160	17.0
Pork ham	19.0	4.8	0.4	.12	63	6.5
Tenmarq wheat	7.0	1.3	2.6	.17	62	7.6
Soybean (average) ..	9.0	2.3	6.4	.61	20	12.0

[12] Data on meat taken from V. H. Cheldelin and R. J. Williams, Univ. Texas Publ. No. 4237, 105, 1942.

A summary of the averaged data obtained in two separate sets of determinations is shown in Table 1. It is apparent that both immature and mature beans of all the varieties tested contain appreciable stores of B vitamins. Comparison of the averaged data for green and mature beans of the six varieties shows with maturation an increase in thiamine and pyridoxine and a decrease in nicotinic acid. Data are presented in Table 2 for the purpose of indicating the comparative vitamin values of meat, whole wheat and mature soybeans. The vitamin values of soybeans compare favorably with wheat and with meats except that riboflavin and nicotinic acid in the beans are lower than in meat. It should be noted, however, that the niacin in immature *Soja* occurs in double the concentration found in the mature beans.

Although it is beyond the scope of this brief account to deal adequately with the evaluation of various plant materials as substitutes for foods of animal origin, it is hoped that the data offered herewith may be of aid in solving some new food problems.[13]

PAUL R. BURKHOLDER

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YALE UNIVERSITY

[8] P. R. Burkholder, *Am. Jour. Bot.*, 30: 206, 1943.
[9] R. J. Williams, Univ. Texas Publ. No. 4237, 7, 1942.
[10] A. S. Schultz *et al.*, *Ind. Eng. Chem. Anal. Ed.*, 14: 35, 1942.
[11] K. A. Evelyn *et al.*, *Jour. Biol. Chem.*, 126: 645, 1938.
[13] Grateful acknowledgment is made to the Nutrition Foundation for financial assistance.

OBITUARY

HAMILTON PERKINS CADY

1874–1943

PROFESSOR HAMILTON PERKINS CADY, a member of the chemistry faculty at the University of Kansas for forty-four years and chairman of the department for more than twenty years, died at his home in Lawrence, Kans., on May 26. His many years of research and teaching brought great credit to the university and much satisfaction to himself.

Dr. Cady was born on May 2, 1874, near Council Grove, Kans., but his family moved further east and his secondary education was secured at the Oberlin, Ohio, high school and the Carleton College Academy at Northfield, Minn. Early in his youth Dr. Cady became greatly interested in the subject of chemistry and made many inorganic and organic preparations in his home laboratory. Since he was unable to buy an analytical balance, he made one which was accurate to less than a milligram and made numerous quantitative analyses by its use.

Upon entering the University of Kansas as a freshman in 1894 young Cady soon became impressed with the similarity of water and ammonia. He read everything available upon this subject, and, during his senior year, laid his collection of information before E. C. Franklin—then associate professor of chemistry at the University of Kansas—with the suggestion that liquid ammonia might reasonably be expected to be an ionizing solvent. Franklin was highly enthusiastic over the idea and persuaded Professor Bailey, chairman of the department, to order a cylinder of liquid ammonia. In preparation for this investigation, Franklin and Cady constructed some vacuum-jacketed test-tubes, for such vessels were not on the market in those days. Franklin had previously agreed to go to Central America for a gold-mining company and departed before the ammonia arrived; so Cady was left to do the experiments alone. His joy was almost unbounded when he found that, although ammonia itself had a high resistance, the addition of a few crystals of potassium iodide produced a highly conducting solution. Thus, this young man who had been fearful that all chemical knowledge would be gained before he could have a part in its discovery had, as an undergraduate student, found something which the world did not know and had given chemists a second ionizing solvent.

After obtaining the bachelor's degree at Kansas in

1897, Cady received a fellowship at Cornell and spent the next two years studying under the direction of Professor W. D. Bancroft. The ammonia work was laid aside, as Bancroft was interested in the phase rule and Dr. Cady later included the latter as one of his "weaknesses." Returning to Kansas as assistant professor in 1899, Cady resumed the work in ammonia and continued to do some research in this field for many years. However, he gradually took up other lines of experimentation, and the ammonia system of compounds was developed by his colleagues, E. C. Franklin and C. A. Kraus.

In 1907, a gas well was drilled near Dexter, Kans., and a local celebration was held in honor of the discovery. However, when an attempt was made to ignite the gas it would not burn. Cady and McFarland analyzed this gas and found that it was mostly nitrogen, but that it also contained 1.84 per cent. helium. Later in analyzing samples of natural gas from the mid-continent field, Dr. Cady showed that many of them contained helium and his work demonstrating the presence of helium in natural gas was of great importance in developing this natural resource.

In the later years of Professor Cady's life, his research was chiefly upon the measurement of the molecular weights of gases, or vaporizable liquids, by means of a special type of Westphal balance. This rapid and highly accurate method is of particular value in determining the purity of organic liquids.

Although Dr. Cady greatly enjoyed research, teaching constituted his real life work. The chief mark of his instruction was his thoroughness. The clear distinction between fact and theory, and the precise statement and understanding of laws and definitions were characteristic of his work in the classroom. Some of his students found such exacting scholarship a great burden, while many thrived upon it, and Dr. Cady considered himself amply repaid for his efforts by the large proportion of his students who have attained eminence in scientific fields.

In personal life, Dr. Cady was a kindly man with an abundance of wit. His amazing store of humorous stories and nonsense verse could be drawn upon to enliven a public address or, more especially, they were used to add sparkle to light conversation with his friends. His death at the age of sixty-nine seems quite untimely. It is to be regretted that another decade was not given to him.

RAY Q. BREWSTER

HAROLD NORRIS ETS

HAROLD NORRIS ETS was born at Rochester, N. Y., on June 10, 1898. His primary education was obtained in the city schools of Rochester, and in 1922, after specializing in chemistry, he received the degree of B.S. from the University of Rochester. From 1920 to 1921 he was chemist with Morris and Company, Chicago. In 1921 he became a member of the department of pharmacology, University of Illinois. He gained the Ph.D. in pharmacology in 1928.

In 1930 he went to Loyola University School of Medicine as assistant professor. From 1940 until his death he held the rank of professor of pharmacology at that institution.

Ets was a productive scholar, well known in the literature. He was highly successful as a teacher and beloved by his students and colleagues. His interest in ethics, in civic and social betterment brought him in contact with the eminent Graham Taylor and other respected social workers in the city of Chicago. His charming personality and active interest in academic and social problems had already gained him a host of friends. A distinguished career was predicted, when he was afflicted with a brain tumor which terminated his work. He died on June 25, 1943. He is survived by his wife, Marie.

H. A. MCGUIGAN

UNIVERSITY OF ILLINOIS
COLLEGE OF MEDICINE,
CHICAGO

RECENT DEATHS

GEORGE W. LITTLEHALES died on August 12 at the age of eighty-two years. He was well known during half a century of Federal service for his contributions to the improvement of the means for the navigation of American shipping.

GUSTAVUS A. ANDEREGG, cable development engineer for the Bell Telephone Laboratories, retired, died on August 15. He was seventy years old.

WILLIAM CLIFT, vice-president and secretary of Phipps and Bird, Inc., Richmond, Va., died on July 28. Mr. Clift was a leader in the activities of the Virginia Section of the American Chemical Society and of the Virginia Academy of Science.

DR. CECIL C. JONES, president and chancellor of the University of New Brunswick, professor of mathematics from 1906 to 1931, died on August 19 at the age of seventy-one years.

DR. E. P. STIBBE, professor of anatomy at the University of London, died on July 23 at the age of fifty-nine years.

SCIENTIFIC EVENTS

THE BIRTH AND DEATH RATES IN GREAT BRITAIN[1]

MORE births were registered in England and Wales during the first three months of this year than in any quarter for seventeen years. The total given in the Registrar-General's return for the quarter ended March 31 last was 171,819. This represents a birth-rate of 16.8 per 1,000 of the population—the highest first-quarter rate since 1928.

Total births and birth-rates in England and Wales for the last five March quarters are:

First quarter	Total births	Rate per 1,000 population
1930	153,382	15.0
1940	154,345	15.0
1941	147,027	14.4
1942	158,225	15.5
1943	171,819	16.8

The number of boys born during the three months of this year was 88,815, a proportion of 1,070 boys to 1,000 girls. The average for the 10 preceding first quarters was 1,058 boys to 1,000 girls. There were 5,782 stillbirths, representing 3.3 per cent. of the total births registered.

There was a decline in the number of marriages, and the total of 62,337 was the lowest for any quarter during the year, although it was still well above the pre-war level of first-quarter marriages.

Deaths in England and Wales (including non-civilians) numbered 137,568. The death-rate (based upon the mid-1939 population) was 13.5 per 1,000, compared with 14.8 in the same period of 1942. For the first quarter of the year it was the lowest rate since 1935 and, having regard to the age of the population, represents the highest first-quarter's mortality on record in this country.

The infant mortality rate was 60 per 1,000 live births, or 14 below the average of the 10 preceding first quarters.

Births registered during the quarter exceeded deaths by 34,251. In the corresponding period of last year the excess was 6,963, but in 1940 and 1941 deaths exceeded births by 50,838 and 31,610, respectively.

RARE CHEMICALS

THE following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

Paraxanthine (1,7 dimethylxanthine)
Dihydroxyacetone phosphate
3-glyceraldehyde phosphate
Difluoroethanol
Trifluoroethanol
Propylene Glycol Monolaurate
Sorbitol Dilaurate
Potassium Palmolate
Diethyl Ketone (3, Pentanone)
Hexylene, boiling point 68° C
Heptylene, boiling point 98° C
Bulbocapnine
Lactic dehydrogenase crystalline
Straub Flavoprotein
Glucosides of mono- or poly-hydroxyanthraquinones

PENICILLIN

REFERRING to a note printed in SCIENCE (August 6, p. 130), Major General Norman T. Kirk, Surgeon General of the Army, writes that because of limited production supplies of penicillin, the new drug which has proved unusually effective in the treatment of infections which do not respond to other treatment, must be carefully allotted according to the most urgent needs. He said:

> Of the total amount available, which is very small, definite allocations must be made to the Army and Navy, and through the Committee on Medical Research, Office of Scientific Research and Development, to the civilian population.
>
> Like all other promising new developments in medicine, an immediate demand has arisen for wide-spread distribution and use of the drug. However, at the present time it must be carefully used to determine its greatest effectiveness. Then as more becomes available it can be administered with exactness to obtain the greatest use for the largest number of people.

All the penicillin available, which is obtained by extremely careful harvesting of green mold grown under ideal laboratory conditions, is used for the treatment of non-healing wounds and infections resistant to other treatment.

The total amount produced is sufficient to treat only a few hundred cases a week and the Army is allocated less than 50 per cent. of that supply, which is insufficient for its needs.

Production and allocation of the drug is controlled by the War Production Board. The percentage made available for civilian use is distributed by Dr. Chester S. Keefer, of the Evans Memorial Hospital, Boston, Mass., who acts for Dr. A. N. Richards, chairman of the Committee on Medical Research of the Office of Scientific Research and Development. All requests to meet civilian needs are handled by these physicians.

[1] *The Times*, London.

AIRCRAFT ENGINEERING

SIR ROY FEDDEN, addressing the Engineering Industries Association in London on July 22 on his recent extensive tour of North America in connection with aircraft engineering, according to *The Times*, London, said that

> he was impressed by the large numbers of technically trained engineers passing out from American universities. Over 14,000 of them took degrees in engineering in 1942, and over 1,400 in aeronautical engineering.
>
> Many American universities and technical schools were provided with up-to-date and elaborate research equipment, which was subsidized and regularly used by industry, and the training given was highly practical as well as theoretical.
>
> With a few outstanding exceptions, our higher engineering training, though sound technically, was for the most part out of date in outlook, and we had practically no up-to-date laboratories in our universities in the true sense of the word. To improve industrial education, classes should be established to help up-grade foremen and charge hands in special shop practices, as well as in supervision and shop management.
>
> There should be university courses on administration, planning and the production methods of precision machine tools, press work, etc. Such matters require specialized technical training just as much as design. In research there must be an adequate supply of scientifically trained people, capable of initiating and planning the right kind of research, and working out solutions promptly and economically.

To implement his ideas Sir Roy suggested that a council of engineering institutions should be established, containing a suitable admixture of youth and age, and of business and technical men.

A POST-GRADUATE COURSE IN INDUSTRIAL MEDICINE

To meet the continued wartime need for a general training course for physicians engaged in or desiring to enter into industrial practise, the Long Island College of Medicine has announced its second postgraduate course in industrial medicine to be given in Brooklyn during the first two weeks of November. The course is modeled on the first series of lectures and seminars in this field presented in November, 1942, in which fifty-nine matriculants from six states enrolled. Enrolment this year will be limited to fifty matriculants for the full course, which is designed for physicians. A limited number of others will be permitted to attend the sessions as auditors.

The course, which is under the auspices of the Department of Preventive Medicine and Community Health and which is directed by Dr. Thomas D. Dublin, associate professor, will run from November 1 to November 12. It will consist of afternoon and evening lectures at the college and morning clinics in the medical departments of near-by industrial plants. The lectures will be given by leading industrial physicians and members of the faculty.

Additional supervised training in the medical department of selected industrial concerns will be provided for those who desire further practical work. Five matriculants enrolled in 1942 elected to take a month of supervised training, and four were aided by the college in finding industrial positions. Thirty-five of last year's matriculants were physicians, of whom seventeen were in full-time industrial practise.

Assisting Dr. Dublin in the formulation and development of the course are Dr. Cassius H. Watson, medical director of the American Telephone and Telegraph Co., alumnus and trustee of the college; Dr. John J. Wittmer, medical and personnel director of Consolidated Edison Co., an alumnus, and Alfred R. Crawford, of the Department of Administration.

Thirty-seven lecturers will take part in the sessions and a series of clinical and laboratory demonstrations is planned. The general topics of the lecture sessions, various phases of which will be discussed, include "The Physician in Industry and His Field"; "Planning an Industrial Medical Department"; "Evaluating the Health Status of the Worker"; "Occupational and Non-Occupational Incapacitation"; "Community Factors in the Health of the Worker"; "Industrial Accidents"; "Protecting the Place of Work"; "Surgical Management of Industrial Injuries"; "Industrial Toxicology" and "Special Wartime Problems in Industrial Medicine."

The printed announcement with all details and the registration forms will be available by September 15. Physicians desiring further information or wishing to apply should address the Office of Administration, 350 Henry Street, Brooklyn 2, N. Y.

THE AMERICAN FOUNDATION FOR TROPICAL MEDICINE

AT a meeting of the Executive Committee of the Board of Trustees of the American Foundation for Tropical Medicine, Inc., in New York City on July 23, according to the report of Dr. Jean A. Curran, executive director, for the six-month period ending June 30, 1943, twelve grants amounting to $43,680 were made.

These grants, made possible by contributions and pledges for the current year of $66,600 by twenty-one American corporations, are being used to strengthen teaching and research programs in tropical medicine and parasitology at the various schools. The approved projects were selected by the medical committee.

Medical schools to receive grants during the period from April 1 to June 30 were: Cornell University Medical College, the School of Medicine of Duke Uni-

versity, the School of Medicine of the University of Pennsylvania and the Medical School of Stanford University. *The Journal of Parasitology* was also aided.

Schools of medicine to which grants were made available during the first quarter of 1943 were: the New York University College of Medicine, the Medical School of Tufts College, the School of Medicine of Tulane University, the Faculty of Medicine of the University of Manitoba, the College of Medicine of the University of Nebraska and the School of Medicine of Yale University.

Companies which have made contributions or formal pledges of support include Abbott Laboratories; American Cyanamid Company; Ciba Pharmaceutical Products Corporation; Firestone Plantations Company; General Foods Corporation; Hoffmann-La Roche, Inc.; The Lambert Company; Lederle Laboratories; Eli Lilly and Company; Merck and Co., Inc.; National Carbon Company; Parke, Davis and Company; E. R. Squibb and Sons; The Texas Company; United Fruit Company; William R. Warner and Company; Winthrop Chemical Company; Winthrop Products, Inc., and John Wyeth and Brother. The foundation also acted as the administrative agency for a special grant from the John and Mary R. Markle Foundation. The executive director stated that other applications are pending, and those recommended for approval will be financed out of contributions. Dr. Curran pointed out that additional gifts would be needed to finance the full program of the foundation for the year 1943.

The program, adopted at the annual meeting of members in January, calls for the collection and disbursement of $100,000 among medical schools and scientific journals and for special projects which fall within its scope.

Officers of the foundation are *President,* Lt. Col. Thomas T. Mackie, director, Division of Parasitology and Tropical Medicine, and executive officer of the course in tropical and military medicine, Army Medical School; *Vice-president,* Dr. Willard C. Rappleye, dean, College of Physicians and Surgeons, Columbia University; *Secretary,* Alfred R. Crawford, assistant to the president, Long Island College of Medicine; *Treasurer,* W. W. Lancaster, partner, Shearman and Sterling; and *Executive Director,* Dr. J. A. Curran, president and dean of the Long Island College of Medicine. Members of the executive committee, in addition to the above officers, are Dr. Theodore G. Klumpp, president of Winthrop Chemical Company, Inc., and Dr. Henry E. Meleney, professor of preventive medicine of the College of Medicine of New York University.

The purposes for which the funds granted during the second quarter of 1943 are being utilized are as follows:

Army Medical Museum. To finance the collection of tropical pathological material and its distribution to American medical colleges.

Cornell University Medical College. Salary aid for full-time instructor in parasitic diseases and to purchase materials for teaching and research.

Duke University School of Medicine. For full-time technician, materials and supplies to establish an identification and distribution center for pathogenic fungi and to maintain a registry of autopsy and biopsy material from cases of fungus disease.

University of Pennsylvania School of Medicine. Salary aid to finance expansion of teaching in parasitology and tropical diseases.

Stanford University Medical School. Salary for full-time technician and funds to purchase supplies and equipment to strengthen teaching of tropical medicine.

Journal of Parasitology. To supplement the publication funds of the *Journal* to permit enlarged type pages.

SCIENTIFIC NOTES AND NEWS

DR. ERNEST CARROLL FAUST, professor of parasitology and acting head of the Department of Tropical Medicine at Tulane University, on August 4 was presented with a diploma of corresponding membership by the Academia Nacional de Medicina of Mexico.

SIR JOHN RUSSELL, director of the Rothamsted Experimental Station, was presented with the Albert Gold Medal of the Royal Society of Arts for 1943 at an informal ceremony on July 26 at the society's house in Adelphi, which was attended by members of the council. The medal was awarded "for his researches and leadership in agricultural science and for his services to husbandry in many lands."

AT the summer commencement on August 13 of Bowling Green State University, Ohio, the honorary degree of doctor of humane letters was conferred on E. L. Moseley, emeritus professor of biology at the university and curator of the university museum.

THE British Institute of Physics has elected the following officers: *President,* Sir Frank Smith; *Vice-presidents,* E. R. Davies, Dr. W. Makower and T. Smith; *Treasurer,* Major C. E. S. Phillips; *Secretary,* Professor J. A. Crowther.

THE *Journal* of the American Medical Association announces the retirement of Dr. Julius W. Sturmer,

since 1916 dean at the Philadelphia College of Pharmacy and Science.

DR. LUDWIK ANIGSTEIN, of the department of preventive medicine and public health of the University of Texas, Medical Branch, Galveston, Texas, has been promoted to be associate professor of tropical medicine.

DR. LELAND A. BROWN, dean and head of the department of biology at Transylvania College, Lexington, Ky., has been appointed acting president of the college. He will serve during the absence of Dr. Raymond F. McLain, who has been granted leave to accept a commission as lieutenant in the Naval Reserve.

DR. P. G. NUTTING, of the U. S. Geological Survey, will retire from active duty on August 31. Formerly engaged in work on optics at the Bureau of Standards and later in charge of research work at the Eastman Kodak Company and the Westinghouse Electric Company, he has since 1925 been making physico-chemical studies of clays and the properties of oil-water-silicate combinations.

OF the twenty-five Beit Memorial Research Fellows, sixteen have been seconded for whole-time war work, and at a recent meeting of the trustees the following elections were made, with permission for each fellow to be seconded at any time for war work: *Fourth Year Fellowships:* J. J. D. King, to continue his studies of dental caries and parodontal disease at the nutritional laboratory of the Medical Research Council. P. C. Williams, to continue his studies of natural and synthetic oestrogens at the Courtauld Institute of Biochemistry, Middlesex Hospital, University of London. *Junior Fellowships:* Margery E. M. Cutting, to study the physiological metabolism of organs in infancy at the department of medicine, University of Cambridge. A. Kleczkowski, to study serological reactions in reference to size and shape of antigen and antibody particles at the Rothamsted Experimental Station, Hertfordshire. G. J. Popjak, experimental study of fatty and degenerative changes in the kidney at St. Thomas's Hospital medical school, University of London. Ethel G. Teece, to study the chemical structure of gram-positive and negative microorganisms and to develop antibacterial agents at the department of chemistry, Birmingham University.

DR. RAY B. CREPPS, associate professor of testing materials and director of the materials testing laboratory of Purdue University, will join Owens-Corning Fiberglas Corporation as director of the testing division of the research laboratories at Newark, Ohio.

DR. ROBERT BRUCE MOFFETT, since 1941 post-doctorate research associate at Northwestern University, has been appointed senior research chemist in the laboratories of George A. Breon and Company.

PROFESSOR WILLIAM J. CONLEY, instructor in applied mechanics and acting chairman of the department of engineering of the faculty of the University of Rochester, has resigned to become consulting engineer with the Lincoln Electric Company at Cleveland.

LINCOLN D. KELSEY, professor of extension service at Cornell University, left on August 17 to join the Agricultural Production Section of the Office of Foreign Relief and Rehabilitation Operations. He will serve overseas in the Mediterranean area.

GORDON E. MCCALLUM, sanitary engineer, U. S. Public Health Service, who has been acting chief of the Sanitary Engineering Section of the Medical Division of the Office of Civilian Defense since January, 1943, has been designated chief sanitary engineer in charge of the section. Mr. McCallum was assigned to the Medical Division in 1941 as regional sanitary engineer for the Third Civilian Defense Region (Maryland, Virginia, Pennsylvania and the District of Columbia) and the States of Ohio and West Virginia, and later was made assistant chief sanitary engineer. Charles I. Mansur, formerly assistant civil engineer at the U. S. Waterways Experiment Station, Vicksburg, Miss., has joined the staff.

DR. LUDWIK GROSS, research associate of the Institute of Medical Research of the Christ Hospital, Cincinnati, has been ordered for duty as Captain in the Medical Corps, U. S. Army. His experimental study on acquired immunity against tumors will be interrupted for the duration of the war.

THE *Times*, London, states that E. Twentyman has been appointed British representative on the interim commission, which was set up by the Hot Springs Food Conference. Mr. Twentyman, who formerly worked at the Treasury Department, is second secretary to the Ministry of Food and is serving as a member of the British Food Mission in Washington.

ACCORDING to plans approved on August 19 by the State Board of Regents, the New York State College of Agriculture at Ithaca and the New York State Agricultural Experiment Station at Geneva will benefit by $7,000,000 in post-war construction. The board acted on the recommendation of its committee on post-war planning in education, of which Vice-Chancellor William J. Wallin, of Yonkers, is chairman. The board already has approved $36,000,000 worth of post-war construction for the educational system of the state. The entire program is subject to the approval of the Temporary State Commission for Post-War Public Work Planning. The New York State College of Agriculture has been allotted $5,619,000 for future building plans, which include nine projects, among them two units costing more than $1,000,000 each. The experimental station at Geneva will receive, ac-

cording to the plans, $1,777,926 for four building units.

THE will of the late John H. Eagle, Philadelphia silk manufacturer, who died last month, bequeaths his estate, estimated at $7,000,000, after a bequest of $1,000,000 to Mrs. Eagle, to the California Institute of Technology and the Salvation Army. The fund for the institute will be used in the prevention and cure of disease and will be known as the John E. Eagle Endowment. It provides for prizes for distinguished service to humanity in the fields of chemistry, physics, medicine and other scientific endeavor.

DRAKE UNIVERSITY has received the sum of $200,000 from the Gardner Cowles Foundation, Des Moines, with which to erect a new science building to be known as Harvey Ingham Science Hall as a tribute to Harvey Ingham, editor emeritus of the *Des Moines Register and Tribune,* who will celebrate his eighty-fifth birthday next month.

THE *Journal* of the American Medical Association states that the State Charities Aid Association has received a grant of $19,000 from the Commonwealth Fund to enable the mental hygiene commission to prepare a plan for aiding men rejected or discharged by the armed forces because of neuropsychiatric conditions. The money became available on July 1.

THE National Society for the Prevention of Blindness announces the award of a prize of $250 for the most original paper adding to the present knowledge of medical treatment of non-congestive glaucoma. This prize is being offered in addition to one that was previously announced for the most valuable original paper concerning early diagnosis.

Nature states that the Royal Society of Arts, London, offers a prize under the Thomas Gray Memorial Trust, the objects of which are "The Advancement of the Science of Navigation and the Scientific and Educational interests of the British Mercantile Marine." The prize is of £50 and is open to any person of British or Allied nationality who may bring to the notice of the society an invention, publication, diagram, etc., which in the opinion of the judges is considered to be an advancement in the science or practice of navigation, proposed or invented by himself during the period from January 1, 1938, to December 31, 1943. Entries that have already been considered by the judges in the years 1938–42 are not eligible for further consideration unless they have since been materially modified. Competitors must forward their proofs of claim between October 1 and December 31 to the Acting Secretary, Royal Society of Arts.

SCIENTIFIC research to develop tests for measuring the intellectual and performance capacities of spastic children will be undertaken by the University of Southern California as the result of an initial endowment of $5,000 made recently by the Crippled Children's Society of Los Angeles County and the California State Society for Crippled Children. The particular phase of the study is being undertaken for the first time and will be supported over a period of five years. Volunteer public and professional organizations, as well as individuals dealing with spastic children, will have access to the psychometric clinic, which is a unit of the department of psychology.

MRS. F. W. WOZENCRAFT, of Washington, D. C., has presented a fund for a lectureship in ophthalmology at the School of Medicine of the University of Texas, in honor of her father, the late Dr. W. J. McReynolds, of Dallas, known for his work on the comparative anatomy of the crystalline lens.

AN Associated Press dispatch dated August 6 states that Secretary Ickes has announced the apportionment of $910,000 to various states for improvement of wildlife conditions. States are required to put up 25 per cent. more to obtain the Federal grants. Federal funds used for the program come from the 10 per cent. excise tax on any ammunition and on sporting arms. The money can be spent only as the Congress authorizes. For this year it approved $1,000,000. Eight per cent. will go for administrative purposes, $9,000 for restoration work in Alaska, $1,000 to the Virgin Islands and the rest to participating states in accordance with their area and number of licensed hunters. Allotments include Connecticut, $2,671; New Jersey, $8,596, and New York, $40,307.

THE Australian correspondent of the *Journal* of the American Medical Association reports that during the past two years the possibilities of agar-agar production in Australia and New Zealand have been explored. In Australia agar is being produced from a red seaweed, *Gracilaria confervoides,* which is easily harvested and is available in quantity. The results so far achieved have been promising. The agar produced has a higher ash and lower nitrogen content than the Japanese variety and a somewhat lower gelling power, but has provided suitable media for the growth of most bacteria. In New Zealand two species of Gelidiaceae offer commercial possibilities owing to their relative abundance, easy identification and good yield. Last year the Council for Scientific and Industrial Research carried out small-scale experiments with one of these, *Pterocladia lucida,* with satisfactory results. Further investigations are now in progress.

DISCUSSION

ARBITRARY EDITORIAL CHANGES IN SCIENTIFIC PAPERS

THE value of proper editing of scientific papers can hardly be questioned. The present writer would be the last to deny that many of his papers have been notably improved by judicious changes requested by the editorial staff of the journals in which they were published. Editors have in general the advantage of age, experience, impartiality and a knowledge of the audience the journal is designed to reach. I have no intention of attacking the procedures of scientific editors in general. However, when nearly every manuscript accepted by a certain journal has its style completely reworked, often without obvious improvement in clarity, there is evidently more room for question. I refer to the changes which are made in two journals in this country which carry many papers dealing with immunology and related subjects. Accepted manuscripts are altered, without consulting the authors, to conform to certain unpublished stylistic preferences of certain of the editors. Among these preferences there evidently figure prominently the addition of an adjectival ending to any word used as an adjective, or if this is not possible, putting a hyphen between the adjectival noun and the noun it modifies, and a ban on words derived from a Latin and a Greek root simultaneously, except in the case of very common words such as automobile. Thus "horse serum" will be changed to "equine serum," or perhaps occasionally "horse-serum," and "monovalent" will be changed to "univalent."

In many cases, no doubt, these changes do not have any particular effect on the sense, and are neither good nor bad. However, cases do occur in which it is open to question whether the meaning remains unimpaired by the change. The flavor of "proteic molecule" is not quite the same as that of "protein molecule," and few, certainly, speak of "proteic chemistry." It may be doubted if a "microscopic slide" is exactly the same as a "microscope slide." In some cases the change definitely seems to be at the expense of clarity. To cite a personal instance, whenever I see "viral antigen" I am irresistibly reminded of "spiral antigen," and thus of protein chains coiling and uncoiling, and the resulting train of thought completely distracts my attention from what the author was trying to say. The difficulties of precise scientific writing seem to be quite great enough without needlessly putting additional mental hurdles in the reader's way in the shape of novel adjectival forms. "Virus antigen" is traditional, it is understood, and I fail to see why it is not good enough.

Sometimes the change to an adjective would clearly modify the author's meaning disastrously. I need only mention "nitrogenous factor," "antigenic extract," "mortal curve," "chesty specialist," and "bloody group." A colleague has inquired what would become of "toothache." Would it be changed to "dental ache," or, to avoid mixing Latin and Anglo-Saxon, to "toothic ache"? The editors would doubtless reply that "toothache" is already one word. All right, but is not "horse serum" really just as much one word, even though we write it as two?

When it is clearly impossible to change to an adjectival form, the editors I am referring to generally insert a hyphen, as "microscope-slide," "phage-antibody," but it is not easy to see how the mere insertion of a hyphen, which has no effect on the pronunciation, is of any value except as a sop to the editorial conscience. Whatever the language may look like when written, it essentially consists of a series of sounds in the mouths of those who speak it, and no number of diacritical marks will change this fact. Some visual aids, such as capital letters and quotation marks, have their value, but one could hardly say the same of that extra hyphen.

If we wish to be really impartial in this problem, there are perhaps two main questions we should try to answer. One is to consider what kind of a language English essentially is and what are the probable trends in regard to the use of endings, and the other is, what are the preferences of those who are actually writing scientific English to-day? If a majority of immunologists are opposed to changing nouns to adjectives, then it would hardly seem justified for the editors of one or two journals to make such changes without authorization.

In so far as the first point is concerned, there can be hardly any doubt that English is a language which tends to use words in different grammatical connections without always changing their forms, and that this tendency has in the past few centuries been on the increase. Our language is descended from the highly inflected Anglo-Saxon. While the impact of French may have had something to do with the change, the theory of some students is that the complexity of case endings, conjugations, etc., eventually became too much for even the Anglo-Saxons themselves, and finding themselves unable to keep track of the multitude of endings, they gradually dropped most of them. Whatever the reason, English is one of the least inflected languages of Europe, but few

will maintain it has suffered as a result. Another great language, Chinese, has totally lost all inflections, but still seems to be able to cope with the task of expressing complicated ideas precisely.

As the opinion of an authority, we may quote the words of the great Danish philologist, Otto Jespersen, close student and lover of the English language, who stated:

> Besides, in a great many cases it is really contrary to the genius of the language to use an adjective at all. . . . *Birthday* is much more English than *natal day* . . . and *eyeball* than *ocular globe*. . . . Mere position before another noun is really the most English way of turning a noun into an adjective, *e.g.*, the *London* market, a *Wessex* man . . . a *Japan* table . . . a *Gladstone* bag, *imitation* Astrakhan. . . . The unnaturalness of forming Latin adjectives is, perhaps, also shown by the vacillation often found between different endings, as in *feudatary* and *feudatory*, *festal* and *festive*.[1]

If we examine the usage of great writers, we can find plenty of evidence that the use of nouns as adjectives is not foreign to the English language. Words like violet, marble, iron, etc., uncompromising as they sound, are all used as adjectives, and forms such as violaceous, marbly, ferrous, etc., have either been dropped, or retained in technical parlance only. Shakespeare says: "the Carthage queen," "Rome gates," "Tiber banks," "through faire Verona streets," "For canker vice the sweetest buds doth love," and Tennyson writes, "Every tiger madness muzzled, every serpent passion kill'd."

That this usage is not confined to poets may be seen by consulting Darwin, who says in the Origin of Species " . . . jackals and species of the cat genus. . . ."

The preference of present-day scientific writers can be studied directly. When I was writing a book on immunology, I took the opportunity of sending out questionnaires to about 30 persons who are either engaged in editing journals in which immunological papers often appear, or who have in the last few years published a number of papers on this subject. Each individual was asked to choose the form he preferred out of a choice of two or three. Not all replied, but the majority did, some with the addition of pencilled notes of encouragement. The pertinent data are shown in Table 1, where the numbers in parentheses show the number of replies favoring the form in question.

TABLE 1

pneumococcus polysaccharide (14), pneumococcal polysaccharide (5)
horse serum (22), equine serum (1), serum of the horse (1)
precipitin test (18), precipitative test (2), precipitation-test (5)
agglutination reaction (20), agglutinative reaction (3)
protein molecule (20), proteic molecule (2), molecule of protein (2)
diphtheria toxin (19), diphtheric toxin (3), diphtherial toxin (3)
inhibition reaction (14), inhibitive reaction (13)
inhibition zone (10), inhibitive zone (2)
antibody formation (14), antibody-formation (9), formation of antibody (6)
antibody specificity (18), antibody-specificity (6), anticorporeal specificity (0)
antigen molecule (14), antigenic molecule (7), antigen-molecule (3)
flocculation reaction (20), flocculative reaction (3).

It is clear that in most cases the majority were decidedly not in favor of adjectival forms. In regard to "pneumococcus" and "pneumococcal" the percentages run 74 against and only 26 for, but in other cases the verdict is even more conclusive. It will be noted that only one person interrogated preferred "equine serum" to "horse serum," and it may be definitely suspected that this was one of the editors responsible for the recent adjectival rash!

In view of the arguments based upon the obvious tendencies in the evolution of English as a language, the examples from classical authors and the clear indication of preference of those who are actually engaged in publishing the results of immunological research, may we venture to hope that in future the use of adjectives will be left to the authors as a purely personal matter? Surely, in this matter, as in others, we shall progress fastest, not by totalitarian compulsion, but by democratic cooperation.

WILLIAM C. BOYD

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[1] "Growth and Structure of the English Language," p. 131, 3rd ed. Teubner, Leipzig, 1919.

GEOLOGY TEXTS FOR LATIN AMERICA

IN SCIENCE for July 2, E. Raymond Hall suggested that advanced scientific texts of North American origin be placed within financial reach of Latin American students. To every one interested in improved relations among Portuguese, English and Spanish-speaking Americans the suggestion is worthy not only of consideration but of immediate action.

A considerable proportion of Latin American colleges are the equivalent of North American junior colleges and in these only introductory courses are offered in many sciences. Among fields usually so treated is geology. The demand, both actual and potential, for English texts in geology is small, due both to small enrolments in such courses and to the prohibitive price of English texts. Frequently the text used is either Italian, German or French in origin. There is no reason why the study should be neglected, nor any reason why the attention of the beginning Latin American student should be turned toward the east, when it could be directed northward.

Geological texts by North American authors, in both Portuguese and Spanish, would do much in stimulating interest in the science itself and even more in promoting hemispheric goodwill. Why should there not be set in motion a cooperative project which would make available excellent texts in physical, historical, structural and economic geology, optical mineralogy, paleontology, etc., in a language, format, binding and price with which Latin American students are familiar?

May it be suggested that each of the various geological societies undertake the publication of a text in their respective fields? The project is herewith submitted to members of the societies with these recommendations:

1. Let an appropriate committee of the American Association for the Advancement of Science learn by inquiry of Latin American educators and geological groups what types of texts would be most welcome.

2. Let the appropriate geological society in the U. S. appoint a group of its members who are willing to donate their services and assign to each of the group chapters of the text for which they shall be responsible.

3. Let the appropriate society sponsor translation into Portuguese and Spanish and first publication of the text in a number determined by inquiry of possible demand, say, for the next three or four years.

4. Let the texts be published by one of the many reputable Latin American publishing companies.

5. Let the texts be marketed through the same or similar agencies, at a cost well within reach of the group for whose use it is intended.

6. Let each text carry an introductory page setting forth the name and nature of the sponsoring society, an invitation for closer Inter-American scientific cooperation and a list of contributing authors.

7. And finally, let action be taken now. These are fast-moving times.

HOBART E. STOCKING

WEST VIEW, PA.

COLORED TRANSPARENCIES OF TROPICAL PLANTS

THE Arctic, Desert and Tropic Information Center has recently received requests as to where colored transparencies or colored photographs of tropical plants may be secured for use or for reproduction purposes. This material has been requested for use in intensive courses of instruction being given by various Army Air Forces Training Units. It is desired to assist army personnel in the recognition of both edible and poisonous plants and fruit in the tropical areas of the present world-wide theaters of operation.

Many of the country's larger and better known museums and scientific institutions have been contacted by the Arctic, Desert and Tropic Information Center with rather discouraging results. To date no appreciable number of the desired colored transparencies have been located.

Because of the wide and select distribution of SCIENCE among American scientists, it has occurred to us that the insertion of a brief notice in this journal stating the urgent need for this materiel might bring prompt results.

ELMER W. ELLSWORTH,
Captain, Air Corps; Chief, Information Collecting and Records Section, ADTIC

CROWN-GALL BACTERIA

SCIENCE SERVICE has just published in SCIENCE, 98: 10, August 13, 1943, a note on "Plant tumor bacteria" which I should like to amend since it credits me with investigations which belong to other workers. The article was prepared from an unannotated summary of work on this subject. Science Service erroneously but innocently assumed that the results summarized were all my own. This was not the case.

The work on attenuation of crown-gall bacteria by cultivation on a medium containing glycine was done by Dr. A. J. Riker at the University of Wisconsin; that on the combined action of attenuated crown-gall bacteria and plant-growth-promoting substances was done at the Rockefeller Institute by Drs. Armin C. Braun and T. Laskaris; that on heat therapy of crown-gall disease in the Madagascar periwinkle was done by Drs. L. O. Kunkel and Armin C. Braun, also at the Rockefeller Institute. I should like to disclaim any direct connection with these investigations. Credit for them belongs to Drs. Riker, Braun, Laskaris and Kunkel, not to me.

PHILIP R. WHITE

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FOR MEDICAL RESEARCH

SCIENTIFIC BOOKS

ORGANIC CHEMISTRY

Organic Syntheses. Collective Volume 2. A Revised Edition of Annual Volumes x–xix. Edited by A. H. BLATT. ix + 654 pp. 6 × 9¼ in. Bound in dark green cloth. New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd. 1943. $6.50.

THE advent of this new collective volume, describing

the preparation of nearly 300 typical organic compounds, will be warmly welcomed by all organic chemists who, with the second edition of Collective Vol. 1, will now have in two compact volumes all the material contained in the first 19 annual volumes of Organic Syntheses, revised and brought up to date, with tables of contents and thumb indexes covering Type of Reaction Index, Type of Compound Index, Formula Index, Illustration Index and General Index. In its preparation, the editor had the assistance of an editorial board of 18 recognized leaders in the field. In the main, it follows the general plan of Collective Volume 1.

In reviewing and revising the subject-matter of annual volumes x–xix, errors have been corrected, calculations, references and the spelling of names (particularly foreign ones) have been verified, modifications and improvements in procedure have been incorporated in the text, and 11 new and checked methods have been added.

As heretofore, the text covering every compound is divided into (1) Procedure, (2) Notes and (3) Methods of Preparation. The last includes all methods of preparative value recorded in *C. A.* up to the end of Vol. 35 (1941), and in some cases still later. A helpful feature is the inclusion in parentheses, under the name of the compound, of the *C. A.* indexing name, where that differs from the title given. Compounds whose preparation is described, but which can be purchased in the open market for $5 or less per kilogram, are marked with an asterisk.

Organic chemists can show their appreciation of the service rendered by the editor and his board in compiling this most useful volume, by forwarding (in duplicate) constructive suggestions for future volumes and calling attention to any errors of omission or commission.

In the judgment of the reviewer, this collective volume, like its predecessor, should be on the shelves of every well-equipped laboratory of synthetic organic chemistry.

Introduction to Organic and Biological Chemistry. By L. EARLE ARNOW, Ph.D., M.D. and HENRY C. REITZ, Ph.D. 6×8¾ in. 736 pp. Illustrated. Bound in dark blue cloth. St. Louis: The C. V. Mosby Co. 1943. $4.25.

As the authors point out, there are many excellent elementary text-books in organic as well as in biochemistry, but no single volume presenting the fundamentals of both fields concisely and coherently. This gap they have endeavored to fill, and the result is a text-book which should be both stimulating and helpful to all interested in the closer correlation of chemistry with the medical and biological sciences, particularly students in premedical, predental, agriculture, nutrition and dietetics, home economics, physical education and similar courses.

Like all Gaul, the book is divided into three parts. Part I (pp. 21–53) covers "Chemical Fundamentals in Review," its two chapters being devoted to "Chemical Facts and Theories" and "Particles in Solution." It is the authors' thought that this will serve mainly as a background to which the student can be referred whenever he exhibits signs of forgetting these fundamentals.

Part II (pp. 54–535) is devoted to "Organic Chemistry" and occupies nearly three fourths of the total book. The classification of its subject-matter follows conventional lines in the main, and is introduced by several pages of useful suggestions as to how to study "Organic Chemistry" most successfully. Another commendable feature of this part is the clothing of the dry bones of chemical facts and reactions with the flesh and blood of human interest and of the progress of civilization and industry.

Part III (pp. 536–694) deals with "Biological Chemistry," and is a summary of the more important phases of metabolism and nutrition, presented more from a chemical than from a physiological or anatomical point of view. An excellent "Summary of Nutritional Requirements" is included.

All the chapters conclude with a series of study questions; and nearly all of them with a list of references to books, monographs, reviews, etc., wherein the student will find additional information.

The Appendix, which contains the "1941 International Atomic Weights" and 16 pages of tables giving the "Composition and Calorific Value of Foods," is followed by an author index and a subject index. The 91 illustrations throughout the text add much to its attractiveness. Paper, type, printing and binding are excellent, and the book fulfills well the purpose for which it was written. The dedication to the late Ross Aiken Gortner touches the heart of the reviewer also, for Gortner was one of his "boys" of whom he was most proud.

Organic Syntheses. Vol. 23. An annual publication of satisfactory methods for the preparation of organic chemicals. LEE IRVIN SMITH, editor-in-chief, with an editorial board and an advisory board. Pp. 124. New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd. 1943. $1.75.

THIS new volume of a well-known, excellent and useful series in general follows closely the plan of its predecessors. New preparations described are the following: Acetylbenzoyl, Alloxan, Alloxantin Dihy-

drate, Bromoacetal, 3-Bromo-4-Hydroxytoluene, Carbobenzoxy Chloride and Derivatives, 1,1-Cyclobutanedicarboxylic Acid and Cyclobutanecarboxylic Acid, Cyclopropyl Cyanide, *beta*-Di-*n*-Butylaminoethylamine, 2,3-Dihydropyrane, *beta,beta*-Dimethylacrylic Acid, *beta*-Dimethylaminopropiophenone Hydrochloride, *beta*-Ethoxyethyl Bromide, *beta*-Ethoxypropionitrile, Ethyl Benzoylacetate, Ethyl Bromoacetate, Indole, Ketene Diethylacetal, Mandelic Acid, *l*-Menthoxyacetic Acid, l-Menthoxyacetyl Chloride, Mesitaldehyde, *beta*-Methylglutaric Acid, *beta*-Naphthaldehyde, *p*-Nitrobenzoyl Peroxide, Pentamethylene Bromide, *alpha*-Phenylethylamine, *beta*-Phenylethylamine, Phthalaldehydic Acid, Pseudoionone, 1(*alpha*-Pyridyl)-2-Propanol, *trans*-Stilbene, Tetrahydrofurfuryl Bromide, Tetrahydropyrane, Tetraphenylcyclopentadienone, Tetraphenylphthalic Anhydride, Tribiphenylcarbinol, Triphenylcarbinol, Triphenylchloromethane.

The subject index at the close is cumulative in the sense that it covers the contents of Volumes 20, 21, 22 and 23. The cumulative indexes for previous volumes in the series will be found in Collective Volumes 1 and 2. The series is so well established as the leader in its chosen field that no eulogy is necessary on the part of the reviewer.

MARSTON T. BOGERT

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THE MOTHS OF SOUTH AFRICA

The Moths of South Africa. By A. J. T. JANSE. Vol. IV. Part I. (Published by the University of Pretoria, South Africa.)

WHEN my wife and I visited Pretoria in 1931, we called on Dr. Janse, and saw his wonderful collection of moths and his great and completely indexed library of works on Lepidoptera. We discussed the forthcoming revision of "The Moths of South Africa," and since that time the volumes have been coming out at long intervals, under circumstances of increasing difficulty. The present part contains a list of the subscribers, but of these, several are in enemy countries, and others are likely to have dropped out. The principal support has come from the National Research Council of the Union of South Africa, and we note that General Smuts has made a generous subscription.

The part just received (dated November, 1942) is of unusual interest because it deals with the most primitive Lepidoptera known, the Hepialids and the Micropterygids. The former are numerously represented in South Africa, with only one species, *Leto venus,* of large size and comparable with the large Australian forms. The genus *Leto* has also one species in New South Wales and one in the Fiji Islands, a distribution suggestive of great antiquity and approaching extinction. It is interesting to note that *Leto venus* has only been found at Knysna, the locality on the coast of South Africa noted for its relict fauna. The Micropterygids appeared to be absent from South Africa until in 1917 Janse took a single female specimen of a new genus and species at Karkloof, Natal. In 1930 he returned to the same spot and took a male, and these two alone represent the known South African Micropterygid fauna.

In the classification of moths, it has always been usual to place the Micropterygids at the bottom of the scale, as nearest to the caddis-flies, from which the Lepidoptera are supposed to have been derived. But Janse now classes the Hepialids as most primitive on various grounds, but thinks they originated quite apart from the Micropterygids, the Lepidoptera being thus diphyletic.

The book is illustrated by eleven plates of Janse's exquisite drawings of structures and five photographic plates of moths. It is dedicated to the memory of Edward Meyrick of England, who described more Microlepidoptera than any one else and a bibliography of Meyrick's publications is included.

T. D. A. COCKERELL

SPECIAL ARTICLES

ON THE TYPE OF CHOLINESTERASE PRESENT IN BRAIN TISSUE[1]

TWO esterases capable of hydrolyzing acetylcholine have been shown[2] to exist in the animal body: a true cholinesterase, acting exclusively on certain choline esters, and a non-specific enzyme hydrolyzing not only esters of choline but a variety of non-choline esters as well. The true cholinesterase exhibits its maximum activity at low concentrations of acetylcholine (around 3 mg per cent.) and displays increasing inhibition with rising substrate concentrations, whereas the non-specific enzyme exhibits its greatest activity at high concentrations of acetylcholine (above 300 mg per cent.) and displays decreasing activity with diminishing concentrations of this substrate. Since the physiological function of the non-specific enzyme is as yet unknown it has been provisionally named pseudo-cholinesterase.

In view of the differences in activity of the two enzymes at high and low concentrations of acetylcholine, measurements at these two substrate concentrations can serve to indicate whether true cholinesterase

[1] A preliminary report on this investigation, which was aided by a grant from the Banting Research Foundation, was presented before the Toronto Physiological Society on December 2, 1942.

[2] B. Mendel and H. Rudney, *Biochem. Jour.*, 37: 59, 1943.

or pseudo-cholinesterase predominates in various tissues or body fluids.

Recently we have found[3] that acetyl-beta-methylcholine is hydrolyzed only by true cholinesterase and not by pseudo-cholinesterase, whereas benzoylcholine is hydrolyzed only by pseudo-cholinesterase and not by true cholinesterase. These facts make it possible to estimate quantitatively the activities of the true cholinesterase and the pseudo-cholinesterase separately in any mixture of the two enzymes.

Using this method determinations were carried out on the same organs of various species in order to ascertain which type of cholinesterase is present.

Since cholinesterase plays an essential role in the chemical transmission of nerve impulses,[4] it was deemed of great importance to find out which of the two enzymes is present in brain tissue. Gray and white matter from the brain of representatives of all the vertebrate classes were investigated. In addition, various other organs, such as parotid gland and pancreas, of several mammalian species were tested. The results are tabulated below (Table 1).

TABLE 1

TYPE OF CHOLINESTERASE PRESENT IN:

	Brain	Parotid gland	Pancreas
Rat	true		
Mouse	true		
Guinea pig	true	pseudo-*	
Rabbit	true	true	
Dog	true	mixture	pseudo-*
Cat	true	mixture	true
Cow	true	true	
Pig	true	pseudo-*	
Chicken	true		
Turtle	true		
Frog	true		
Carp	true		

* Traces of true cholinesterase present.

The results listed in Table 1 show that the brains of all the vertebrates tested contain only true cholinesterase and no pseudo-cholinesterase. This fact demonstrates that in brain tissue it is the true cholinesterase which performs the function of hydrolyzing acetylcholine after it has been liberated.

The other organs tested, however, show no regularity as to the type of cholinesterase present, *e.g.*, the parotid glands of various species may contain true cholinesterase or pseudo-cholinesterase or both. Similarly, the pancreas of the cat contains only true cholinesterase, while that of the dog contains only pseudo-cholinesterase.

Summary: Brain tissue of all vertebrates contains only true cholinesterase.

No general statement concerning the type of cholinesterase in any other organ can be made, since true cholinesterase may be present in a particular organ of one species and pseudo-cholinesterase in the same organ of another.

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HARRY RUDNEY

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[3] B. Mendel, D. P. Mundell and H. Rudney, in press (*Biochem. Jour.*)

[4] B. Mendel and R. D. Hawkins, in press, *Jour. Neurophysiol.*, 99.

ENTRANCE OF CHLORIDE WITH POTASSIUM INTO LIVE RAT MUSCLE FIBERS—CL-SPACE ERROR

THE muscle of animals after adrenalectomy with high plasma potassium contains more extracellular fluid[1,2] expressed as Cl-space (*liters* of *plasma water* calculated to contain all Cl in 1 kg muscle) than after DOCA therapy[3] when plasma K is low. This result, surprising in view of Na retention in the latter case, may be elucidated by, in fact, is a good test of, the Boyle and Conway[4] theory, in which Cl enters muscle fibers as KCl in a Donnan equilibrium. Tested to date only in excised and immersed frog muscle, the theory is now tried in live rats. Conditions predicted to increase fiber Cl were imposed: a doubled plasma K and an 11 per cent. increase in fiber water. Fiber Cl, designated as Cl- minus inulin-space, increased 75 per cent. The error involved by designation of extracellular fluid as Cl-space, error expressed as (Cl- minus inulin-space)/(inulin space), is 44 per cent. before, 58 per cent. after imposing the condition. Thus the Cl-space error is not only absolute[5] but also dynamic or functional. Thiocyanate-space should involve similar errors.

Of rats nephrectomized under ether, litter mate A received intraperitoneally 66 ml/kg of a solution containing 3.75 gm per cent. inulin or equivalent sucrose, 150 mM Na, 125 mM Cl, 25 mM bicarbonate; in mate B, 50 mM K replaced equivalent Na and only this rat received drinking water during the 22-hour equilibration. Only sheet muscles taken under amytal from the thighs were stripped into slender pieces and cleared of connective tissue, fat, and visible blood. The *same* zinc filtrate of muscle or plasma gave aliquots for the Volhard chloride and the Seliwanoff color reaction for inulin or sucrose as fructose.[6] The small uniform muscle "fructose" blank was deducted. Equilibrium was attained as revealed in comparable inulin- and sucrose-spaces and in comparable chloride and inulin values for plasma and the occasional peritoneal water.

[1] A. H. Hegnauer and E. J. Robinson, *Jour. Biol. Chem.*, 116: 769, 1936.

[2] D. C. Darrow, H. E. Harrison and M. Taffel, *Jour. Biol. Chem.*, 130: 487, 1939.

[3] D. C. Darrow and H. C. Miller, *Jour. Clin. Investigation*, 21: 601, 1942.

[4] P. J. Boyle and E. J. Conway, *Jour. Physiol.*, 100: 1, 1941.

[5] L. V. Heilbrunn and P. G. Hamilton, *Physiol. Zoöl.*, 15: 363, 1942.

[6] K. Steinitz, *Jour. Biol. Chem.*, 126: 589, 1934.

Concentrations of Cl in fiber water, calculated as (Cl- minus inulin-space) (conc. Cl in plasma water)/(muscle water minus inulin-space), are matched with plasma K (chloroplatinate analysis[7]) in Table 1. The correlation is + 0.71 with a P value equal

TABLE 1

PLASMA K AND MUSCLE FIBER Cl IN RATS
MM./L. OF PLASMA OR FIBER WATER

Group A		Group B	
Plasma K	Fiber Cl	Plasma K	Fiber Cl
6.9	4.9	8.8	7.7
7.0	10.7	10.7	10.3
7.4	1.9	10.8	8.2
8.5	9.0	11.8	7.0
8.1	8.0	...	10.0
8.3	7.0	12.4	12.1
8.6	2.5	14.2	11.6
10.1	9.0	14.7	12.9
14.9	13.2	15.9	11.2

to 0.0014 that the scatter result from uncorrelated material. From Boyle and Conway, $Cl_1/d_1 = Cl/d$,[8] and if in the rat as in the frog $d_1 = K$, then $Cl_1 = (Cl/d)K$. The regression equation for the combined data of Table 1 is $Cl_1 = 0.28 + 0.795\ K$. With $(Cl/d) = .795 = 107.5/d$,[9] $d = 135.2$ and $d - Cl = 27.7$, a very likely value for diffusible anions other than Cl in plasma, particularly bicarbonate.

The negative correlation − 0.21, P = 0.20, between plasma Cl and fiber Cl/unit dry weight, though determined over a limited range of plasma Cl values, does not support adsorption of Cl as such. It may mean, if any of the plasma *K* in nephrectomy comes from endogenous source in company with anions other than *Cl*, a reduction of plasma *Cl* as this *Cl* enters the fibers with *K*. Such transfer may explain instances of fall in plasma *Cl* when the kidney is excluded and plasma *K* elevated: chronic nephritis, adrenaline release, hemorrhage, shock, asphyxia, local venous stasis, etc.; and, of course, the opposite when plasma *K* is lowered: excess cortical hormone, anesthesia.

The muscles of group A contained an inulin-space 15.8 per cent. larger than those of B. This suggests the inability of *K* compared to *Na* to support interstitial fluid bulk even after nephrectomy. Entrance into fibers of *K* as KCl from fluids containing *K* substituted for Na naturally entails entrance of water because of hypotonicity. Entrance of *K* in exchange for *Na*, assuming equal ionization inside, would involve no water shift.

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[7] W. S. Wilde, *Jour. Biol. Chem.*, 128: 309, 1939.
[8] Italicized symbols represent "activities"; d = sum of diffusible anions; subscripts indicate "fiber" ions, other ions being interstitial.
[9] 107.5 is mean plasma water Cl for all rats.

PIGMENT PRODUCTION BY TUBERCLE BACILLUS IN THE PRESENCE OF P-AMINOBENZOIC ACID

PURSUING studies on the chemotherapeutic relationship between Mycobacterium tuberculosis and fungi,[1] an intensive yellow pigmentation has been observed in cultures of a certain strain of *Tubercle bacillus* when grown in the presence of high concentrations of p-aminobenzoic acid (PABA). That the formation of this kind of pigment apparently is not restricted to the *Tubercle bacilli* and has perhaps a general significance is suggested by a recent publication by Spink and Vivino.[2] These authors described the development of a yellow pigment in cultures of staphylococci when grown in the presence of sulfa drugs.

Strain No. 607 of the American Type Culture Collection, growing first in Sauton's, later in Long's medium, was employed for the study reported here. Formation of the yellow pigment takes place in PABA concentrations of 1:1000 to 1:3000 after an incubation of about one week. At first the color is a bright yellow, but the cultures often gradually become brownish. Numerous conglomerations of yellow crystals are visible microscopically between and around the bacilli which occasionally grow like fungi in long threads and chains. No similar coloration could be observed in the presence of sulfathiazole, sulfathiourea, aniline, sulfanilic acid or paraphenylenediamine.

Benzoyl-γ-(2-methylpiperidino)-propanol hydrochloride, selected as an example of an amine-free derivative of benzoic acid, was without effect; by contrast, p-aminobenzoyl-diethylaminoethanol hydrochloride (Procaine) gave a very intense color if concentrations of 1:250 to 1:500 were used. (Notice that this quantitative relation between PABA and Procaine is about the same as in their antisulfonamide activities.)

Since the tubercle bacillus forms considerable amounts of riboflavin under identical conditions, I first considered the possibility of an increased riboflavin formation due to the presence of PABA; my recent findings, however, indicate that the yellow pigment here described is not identical with Vitamin B_2. In the absence of PABA no pigment is formed if the magnesium content of the medium is changed or if mercuric chloride is added to the medium. It is known that changing the concentration of magnesium or addition of $HgCl_2$ increases considerably the riboflavin formation by *Aspergillus niger*.[3]

The pigment is insoluble in ether, chloroform or petrol ether, but it is highly soluble in concentrated

[1] R. L. Mayer, *Revue Medical France*, December, 1941, 3–19; see C.A. 36: 5199, 1942.
[2] W. W. Spink and J. J. Vivino, SCIENCE, 98: 44, 1493.
[3] G. S. Kitavin, *Cpt. rend. acad. Sci. URSS*, 28: 517, 1940.

acetic acid and phenol. Under the microscope, tubercle bacilli containing this pigment reduce ammoniacal $AgNO_3$ and Fehling's solution.

Studies are under way in order to determine the possible relationship of this pigment to a metabolite derived from PABA and especially to factors of the vitamin B complex.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

GLYOXAL, A NON-IRRITATING ALDEHYDE SUGGESTED AS SUBSTITUTE FOR FORMALIN IN HISTOLOGICAL FIXATIONS

MANY histologists who find the traditional formaldehyde solution distressing to the eyes and nose would doubtless welcome a less offensive hardening agent of equal efficiency. Glyoxal, or oxalic aldehyde, which has recently become available[1] in fair quantities, appears very promising in this respect.

Glyoxal, whose molecule consists merely of two linked aldehydic groups, and is the simplest of the dialdehydes, has been recommended by the manufacturers as an "insolublizing agent" for protein materials such as casein, albumin, gelatin and glues. This suggested to us that perhaps the dialdehyde could also be applied for hardening animal tissues in histological fixation.

A variety of tissues of the mouse was tried in different strengths of glyoxal. Reasoning that the ordinary "10 per cent. formalin" is approximately a 4 per cent. formaldehyde solution, and that glyoxal has two aldehyde groups, one would expect a 2 per cent. solution to be about right. Liver, kidney, muscle of leg, tongue, heart, skin, spleen, lung, brain and fatty tissue of the breast of mouse were used and human breast tissue and brain. With small blocks of tissue, we found the 2 per cent. glyoxal to compare very favorably with 10 per cent. formalin, with the possible exception of muscle. Nuclei were well stained in all specimens. Even a 1 per cent. glyoxal solution was adequate for small samples of many tissues. Concentrations much higher than 2 per cent. were not suitable for small blocks. The addition of acetic acid yielded poorer results. Controls were run with 10 per cent. formalin. Only haematoxylin-eosin stain was employed, no difference being noted in the coloration of tissues between those fixed in formalin and in glyoxal.

When large masses of tissue, such as an entire human brain, were fixed, 10 per cent. concentration and slightly longer time was necessary. Either the weaker solution was exhausted or the larger glyoxal molecule does not diffuse as readily as formaldehyde.

Glyoxal is now supplied as a crude 30 per cent. to 40 per cent. aqueous solution, deep yellow and syrupy in consistency. It is quite impure and too acidic to be used without treatment. Dilute the crude solution to 10 per cent. concentration with tap water. Add powdered calcium carbonate, and stir until effervescence ceases. Frothing is severe but can be controlled by adding a little ethyl ether. Filter by suction through a rapid crepe paper. Pass through a second time if not clear. Dilute further to 2 per cent., or as desired. The final solution will be still faintly acidic (to litmus) and should be left so, never alkaline. It has only a weak odor and is not irritating.

A 30–40 per cent. crude solution of glyoxal sells for one dollar a pound in lots of a gallon or under. However, at 2 per cent. dilution it costs only about 10 to 15 cents a liter. It is expected to become cheaper and more abundant, but even now 50 gallons of the 30–40 per cent. concentration can be purchased on one order.

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[1] Carbide and Carbon Chemicals Corporation, 30 East 42nd St., New York. We are most grateful to F. J. Rauscher of the St. Louis office for generous samples of glyoxal solution.

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